IMPROVED PACKAGING FOR GOLF BALLS

Background of the Invention

This application is a continuation-in-part of U.S. Patent Application Serial No. 09/075,128, filed May 8, 1998, which is a continuation-in-part of U.S. Patent No. 5,875,652, issued March 2, 1999, which are hereby incorporated by reference.

Field of the Invention

The present invention relates to improved packaging for golf balls. More particularly, the present invention relates to golf ball packaging that preserves mechanical and physical characteristics of balls during prolonged storage.

Description of the Related Art

Golf balls generally come in two different varieties, solid golf balls and multi-piece golf balls. Solid golf balls are usually used for practicing and where high performance is not a priority, such as in driving ranges. Multi-piece golf balls, however, exhibit better playing characteristics than solid golf balls and consequently are used on golf courses during play.

A solid golf ball generally consists of a polymeric sphere having a plurality of molded dimples which aid the flight characteristics of the golf ball. A multi-piece golf ball generally consists of either a wound or solid rubber core that is covered with a separate and distinct cover. The cover often comprises a single thermoplastic layer. Recently, new types of multi-piece golf balls have been introduced having a multi-layered compound including a plastic mantle surrounding a solid polybutadiene rubber core and an external thermoplastic envelope. The solid core, or the center of a wound core, is generally made of an elastomer, such as a polybutadiene with high cis content which is combined with a zinc or other metal salt of unsaturated fatty acid. Often, small amounts of zinc oxide are also added to the core in order to achieve a higher performance in restitution, as described below.

The cover of a multi-piece golf ball is typically made from a material that contributes to the durability of the ball and also provides the particular "feel" of the ball when struck with a club. By way of example, a two-piece golf ball construction of a rubber core and an ionomer cover generally provides a very durable ball and increases ball

travelling distance when struck with a club.

Golf ball manufacturers have recently introduced a new type of two-piece golf ball specially designed for use by professional players. The new golf balls provide a softer feel to the ball when struck with a club. Manufacturers have achieved this characteristic by lowering the core compression and softening the cover of the golf ball.

Golf ball manufacturers have also recently developed a three-layer golf ball having an intermediate mantle between the core and the cover. The three-layer golf ball provides a softer feel to the golf ball while also providing increased distance and durability. In such a golf ball, it is advantageous to use a thermoplastic material for the mantle, such as a pure or blended ether block copolymer (e.g., PEBAX®), as is disclosed in U.S. Patent No. 5,253,871.

These newer constructions are driven, in part, by a desire to obtain the maximum allowable initial velocity value for golf balls. The United States Golf Association (USGA) issues rules that govern the allowable ranges of initial velocity values for golf balls. According to the USGA rules, the initial velocity must not exceed a value of 250 feet per second, with a maximum tolerance of 2%. Consequently, golf ball manufacturers have striven to manufacture golf balls that have an initial velocity as close as possible to the 255 feet per second limit without exceeding this value.

Golf balls, once manufactured, often are stored by the manufacturer, distributor and ultimate purchaser for extended periods of time prior to use. Unfortunately, there are certain drawbacks that are associated with prolonged storage of multi-piece golf balls. Among these drawbacks is moisture absorption.

Multi-piece golf balls typically absorb moisture when they are subjected to prolonged storage in uncontrolled environments. Moisture absorption can affect the weight of the ball, as well as certain physical and mechanical characteristics of the various materials that make up the different pieces of the golf ball structure, including the cover, the core and the mantle.

Consequently, the initial velocity of the golf ball is affected by moisture absorption. Recently, moisture has been found to significantly affect the initial velocity value of a golf ball over time. Figure 1 is a graph of predicted velocity losses over a period of twelve months. In particular, the figure plots the initial velocity value as a

function of time for stored golf balls. As illustrated in Figure 1, the initial velocity loss is approximately 2.5 ft/sec., or 1.7 mph, over twelve months for golf balls having a soft cover, between 50 to 60 shore D, in an environment of 72° F and 50% of relative humidity (RH). Such an initial velocity loss of 2.5 ft/sec corresponds to a loss of distance of approximately 6 to 10 yards when the ball is struck with a driver. For a golf ball having a hard cover, between 68-72 shore D in the same conditions, the initial velocity loss over 12 months is approximately 0.5 ft/sec, or 0.3 mph.

As illustrated by the projected data lines of Figure 1, moisture absorption is a particularly acute problem for soft cover balls. This results, at least in part, from the fact that the soft cover is more permeable to moisture than the hard cover. Thus, the moisture reaches the core more easily. Also, because the core is often made of a highly hygroscopic material, it absorbs this moisture, which further degrades the core's desired properties. The degradation in performance characteristics is generally accelerated when the ambient storage temperature becomes higher. For a soft cover ball at a temperature around 110° F and 50% RH, a velocity loss of 2.5 ft/sec occurs in only few weeks, as opposed to twelve months for a soft cover ball in an environment of 72° F and 50% RH. During transportation of the golf balls from the manufacturing facility to a retail store, actual storage conditions are closer to the elevated temperature conditions. Consequently, soft cover balls may experience a large reduction in performance characteristics when being transported from the manufacturing facilities to the retail store.

Three-layered golf balls also encounter a similar problem with moisture absorption. A three-piece golf ball including a polyamide elastomer-based mantle, such as PEBAX®, is sensitive to water absorption. The characteristics of such a golf ball can change significantly during a relatively short period of time if the ball absorbs moisture. In particular, the characteristics of hardness, weight, volume, tensile strength, elongation, resiliency, and modulus, among other characteristics, can vary significantly after a prolonged stay in uncontrolled environments.

Golf ball manufacturers have proposed various golf ball configurations in an effort to inhibit moisture absorption. United Kingdom Patent Application 2,280,379 proposes to include in the golf ball structure a moisture barrier layer that has a lower water vapor transmission rate than the golf ball cover. The golf ball thus includes a cover that has a

thickness of at least 30 mils and that features a continuous moisture barrier layer surrounding the inner core. While this golf ball is designed to increase the shelf life of a ball by inhibiting moisture absorption, it also presents many drawbacks. First, the moisture barrier layer is generally made of a material that does not readily adhere to the adjacent materials in the golf ball structure and the various layers of the golf ball structure may move relative to one another, such as through rotation. Therefore, the spin rate of the ball is reduced because the momentum transferred to the ball is significantly less than if the inner layers initially moved at the same rate as the outer layers. Second, to maintain desirable ball characteristics, the acceptable thickness of the moisture barrier layer is limited. For instance, if the moisture barrier layer is too thick, it would necessarily displace resilient materials. Also, if the moisture barrier layer is made too thin, it will not sufficiently inhibit moisture absorption. Accordingly, the moisture barrier layer generally forms a minor layer of a cover that is relatively thick, which can be undesirable.

United Kingdom Patent Application 2,280,379 also discloses a golf ball having a moisture barrier layer positioned outside the golf ball clear coat. The clear coat is a solution that is applied to the outer surface of a golf ball to protect the ball and to add an aesthetically pleasing appearance by providing the ball with a high gloss and mirror-like finish. Unfortunately, positioning the moisture barrier layer outside the clear coat is undesirable since it may subject the moisture barrier layer to damage during use. Another drawback associated with placing a water barrier around the clear coat is that the barrier layer significantly reduces the clear coat's transparency and glossy appearance. This may adversely affect the appearance of identifying indicia, such as trademarks, logos, model names, etc., that are often placed on the golf ball. Finally, the golf ball of U.K. Application 2,280,379 is complicated to manufacture and involves steps for which special precautionary measures are required. For example, the core is dipped in a solvent solution, such as toluene, which is a known toxic and cancer-causing chemical.

Japanese Patent Application No. 7-187268 discloses a packaging for golf balls. The packaging is made of a heat-shrinkable film that is shrunk over golf balls for storage. The film enables the golf balls to be arranged in a tight configuration of lines or rows. Perforations are made in the film to facilitate the evacuation of air during the process of heat-shrinking the film. While this type of packaging eliminates bulk by enabling a

collection of golf balls to be tightly packed, it does not address the problem of moisture absorption by the golf balls after they are packed and during storage. The packaging disclosed in JPA 7-187268 does not act as a moisture barrier, as the perforations in the packaging make it permeable to moisture.

Currently, most manufacturers pack golf balls in rigid paper or cardboard boxes. Such packaging is highly susceptible to moisture penetration and, therefore, moisture absorption by the golf balls. As discussed above, such moisture absorption greatly reduces the performance characteristics of the ball.

There is therefore a need for golf ball packaging that can be used to store golf balls prior to first use and that can reduce the damage associated with difficult storage and shipping conditions, such as moisture. Such golf ball packaging should sufficiently protect the golf ball to ensure the freshness of the golf ball and to preserve the optimum properties of the golf ball prior to first use, while also preserving and protecting the structure of the ball. The packaging should be both capable of protecting single or multiple golf balls and of retaining the physical and mechanical properties of the ball, such as the initial velocity value and the coefficient of restitution, for prolonged periods of time until the packaging is opened.

<u>Summary of the Invention</u>

The aforementioned needs are satisfied by the present invention which involves improved golf ball packaging that sufficiently protects the structure of golf balls during storage and also inhibits moisture absorption in the golf balls.

Accordingly, one aspect of the present invention involves in improved golf ball packaging assembly to increase the shelf life of soft cover golf balls. The assembly comprises a container and at least one soft cover golf ball. The container comprises a structural member that defines a cavity sized and configured to retain the golf ball. The container further comprises an opening extending into the cavity and a removably attached sealing member that covers the opening. The container also comprises a vapor barrier that substantially, and preferably completely, encases the golf ball. The vapor barrier transmits a first rate of vapor into the cavity and the golf ball absorbs vapor from within the cavity at a second rate with the first rate being lower than the second rate.

The present invention also involves a golf ball and package assembly that

reduces the effect of ambient humidity upon a golf ball contained within the package during prolonged storage. The assembly comprises a housing defining an interior cavity sized to receive at least one golf ball. The housing forms, in part, a moisture barrier with a lip that is positioned on the housing. The lip surrounds an aperture that communicates with the interior cavity. A flexible lid is removably mounted on the lip and comprises, in part, the moisture barrier. The golf ball is disposed within the interior cavity.

A further aspect of the present invention involves a golf ball and package assembly that reduces the effect of ambient humidity upon a golf ball positioned within the package during prolonged storage. The assembly comprises a housing defining an interior cavity. The housing has a lip that surrounds an aperture that communicates with the interior cavity. A flexible cap is removably engaged to the lip on the housing and the flexible cap is configured to be peeled from engagement with the lip. The housing and the flexible cap form a vapor barrier when the cap is engaged to the lip on the housing. A golf ball is positioned within the interior housing.

Another aspect of the present invention involves a golf ball and a container assembly that reduces the effect of ambient humidity upon a golf ball positioned within the container during prolonged storage. The assembly comprises a container and a golf ball positioned within the container. The container comprises a housing having an outer surface and defining a cavity. The cavity being sized and configured to receive the golf ball. A vapor barrier being formed separate from the golf ball and encasing the golf ball to limit moisture absorption by the golf ball. The container also comprising an opening that extends into the cavity through the housing. The opening is sized and configured to allow the golf ball to pass through the opening. A closure is removably attached to the housing and is positioned over the opening such that the closure closes the opening into the cavity.

A further aspect of the present invention involves an improved golf ball and package assembly comprising at least one golf ball and a package separable from the golf ball. The package defines at least one cavity within which the golf ball is positioned. The package also includes a sealable cover that encloses the cavity such that the package encases the golf ball. The package reducing vapor transmission into the

cavity such that the golf ball loses less than about 1 mile per hour of initial velocity after twelve months of storage at about 72 degrees Fahrenheit and about 50 % relative humidity.

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Moreover, the present invention involves an improved golf ball and package assembly comprising at least one golf ball and a package separable from the golf ball. The package defines at least one cavity within which the golf ball is positioned. The package also includes a sealable cover that encloses the cavity such that the package encases the golf ball. The package reduces vapor transmission into the cavity such that the golf ball loses less than about 1 mile per hour of initial velocity after twenty-four months of storage at about 72 degrees Fahrenheit and about 50 % relative humidity.

Brief Description of the Drawings

These and other features, aspects and advantages of the present invention will now be described with reference to the drawings of several preferred packaging arrangements, which arrangements are intended to illustrate and not to limit the present invention, and in which figures:

Figure 1 is a graph projecting variations of golf ball velocity as a function of storage time for two types of golf balls under similar environmental conditions, the graph is a projection of data based upon a period of testing of a number of months;

Figure 2 is a side elevation view of golf ball packaging having certain features, aspects and advantages in accordance with the present invention;

Figure 3 is a cross-sectioned view of the packaging of Figure 2 taken along 3-3 in Figure 2;

Figure 4 is an enlarged cross-sectioned view of a portion of the packaging of Figure 2;

Figure 5 is a side elevation view of another golf ball packaging arrangement having certain features, aspects and advantages in accordance with the present invention;

Figure 6 is a top plan view of the packaging of Figure 5;

Figure 7 is a partially sectioned side elevation view of the packaging of Figure 5 illustrating an exemplifying golf ball positioned therein;

Figure 8 is a perspective view of a further golf ball packaging arrangement having certain features, aspects and advantages in accordance with the present invention;

Figure 9 is a partially sectioned side elevation view of another golf ball packaging arrangement having certain features, aspects and advantages in accordance with the present invention;

Figure 10 is a cross-sectional side view of another golf ball packaging arrangement having certain features, aspects and advantages in accordance with the present invention;

Figure 11 is a perspective view of a further golf ball packaging arrangement having certain features, aspects and advantages in accordance with the present invention;

Figure 12 is a perspective view of the packaging of Figure 11, with the lid shown in a sealed state;

Figure 13 is a perspective view of another golf ball packaging arrangement having certain features, aspects and advantages in accordance with the present invention, the packaging having a lid shown in a removed state;

Figure 14 is a side elevation view of the packaging of Figure 13 including a lid illustrated in a removed position;

Figure 15 is an enlarged sectioned view of the packaging of Figure 13 taken along the line 15-15 in Figure 14;

Figure 16 is an enlarged sectioned view of the lid for the packaging of Figure 13 taken along the line 16-16 in Figure 14;

Figure 17 is a sectioned view of the lid in position on the packaging;

Figure 18 is a bottom plan view of the packaging of Figure 13;

Figure 19 is a graph illustrating the distance performance of a golf ball stored within the inventive packaging over time in comparison to a golf ball stored in a prior art container;

Figure 20 is a graph illustrating the velocity performance of a soft cover golf ball

stored within the inventive packaging over time in comparison to a soft cover golf ball stored in a prior art container;

Figure 21 is a graph illustrating the velocity performance of a hard cover golf ball stored within the inventive packaging over time in comparison to a hard cover golf ball stored in a prior art container;

Figure 22 is a graph illustrating the velocity performance of a soft cover golf ball stored within the inventive packaging over time in comparison to a soft cover golf ball stored in a prior art container;

Figure 23 is a graph illustrating the velocity performance of a hard cover golf ball stored within the inventive packaging over time in comparison to a hard cover golf ball stored in a prior art container; and

Figure 24 is a graph illustrating a degree of loss of coefficient of restitution over 12 weeks by soft cover golf balls stored within the inventive packaging in comparison to soft cover golf balls stored in a prior art container.

Detailed Description of the Preferred Embodiment

The various golf ball containers that will be described exhibit improved resistance to moisture transmission over prior golf ball containers. As mentioned, moisture absorption adversely affects the performance of a golf ball subjected to prolonged storage. It is believed that the present inventor is the first to recognize the potential and the importance of using golf ball packaging to reduce moisture absorption in golf balls.

Conventionally, golf balls are shipped, stored by the seller, sold and stored by the end user in folded, box-shaped paper board or cardboard sleeve packages. While other forms of containers are sometimes used for promotional purposes and can have slightly better moisture barrier characteristics than a standard paper board or cardboard container, such containers are not intended to form a moisture absorption barrier. As such, these promotional containers do not provide a sufficient moisture barrier to prevent significant degradation of golf ball performance due to moisture absorption over time. Moreover, many of these forms of packaging would be undesirable for marketing golf balls because of greatly increased material, manufacturing, and shipping costs.

In commerce, a golf ball will typically be sold within 4-12 months of manufacture. It will then be kept a period of time by a wholesaler and/or retailer, and for another period

of time by the golfer, before being used. Manufacturers suggest that wound balls be used within two years of manufacture and that two-piece balls be used within five years of manufacture. However, balls are not typically marked with a manufacturing date, and actual storage time periods may exceed guidelines.

Additionally, golf balls are often stored over a wide range of temperatures and humidities. The golf ball can be exposed to extremely high temperatures while being shipped to the retailer or in a storage facility. A ball can then be stored by a retailer at a standard room temperature of 72° F. Golfers can then store golf balls within a golf bag that is kept in the rear trunk of a vehicle, which can reach extremely high temperatures, such as during the summer season. These temperatures can reach well in excess of 110° F. Such extreme temperatures can accelerate the degradation in performance of the golf ball.

With reference now to Figures 2 and 3, golf ball packaging 20 having certain features, aspects, and advantages in accordance with the present invention is illustrated therein. The golf ball packaging 20 desirably is configured to enclose a plurality of golf balls 21 for storage or transport but can enclose a single golf ball. The packaging 20 advantageously inhibits moisture transmission so as to protect the enclosed golf ball from damage associated with moisture, as described in detail below. Because the packaging inhibits moisture transmission, it can be used for prolonged golf ball storage to substantially preserve desired performance characteristics of the enclosed balls.

With continued reference to Figures 2 and 3, a presently preferred packaging arrangement 20 includes a sealing member 22 that is comprised of a collection of individual member portions 24, 26, 28, each defining a cavity 32. The cavities 32 preferably have a size and shape that generally conforms to the size and shape of a golf ball. Each of the cavities 32 in the illustrated member portions 24, 26, 28 is hermetically divided from the others and contains a single golf ball 21.

In accordance with one aspect of the present invention, the sealing member 22 advantageously forms a moisture barrier that substantially inhibits transmission of water and water vapor into the cavities 32. Moreover, when packaging golf balls within the sealing member 22, a vacuum is preferably pulled between the sealing member 22 and the golf balls in order to ensure a minimum amount of residual humidity on the golf ball

surface. More preferably, the packaging process occurs under dry-air conditions in order to further reduce the amount of initial humidity within the cavity 32.

With continued reference to Figure 2, a sealing joint 34 separates the first member portion 24 from the second member portion 26. A second sealing joint 36 similarly separates the second member portion 26 from the third member portion 28. In addition, sealing joints 40, 42 are located on the left and right outer edges, respectively, of the illustrated sealing member 22. As used herein, reference to the terms "left" and "right" are with respect to the illustrations contained herein and are not intended to limit the scope of the invention.

A tear line 44, such as a series of perforations or other area(s) of reduced or comprised strength, is aligned with the sealing joint 34 on the illustrated sealing member 22. A second tear line 46 is preferably aligned with the sealing joint 36 between the second member portion 26 and the third member portion 28. Preferably, the tear lines 44, 46 are produced along each of the sealing joints 34, 36 in order to facilitate the separation of any of the member portions 26, 28, 24 from the others. Although Figures 2 and 3 illustrate the sealing member 22 as having a row of three member portions 24, 26, 28, any number of member portions may be arranged in the sealing member 22 in any of a wide variety of spatial relationships.

With reference now to Figure 4, the illustrated sealing member 22 is generally comprised of a thin-sheet, multi-layer material 50. The sheet material 50 is preferably a composite structure, such as a multi-layer film or laminate structure that includes a plurality of functional film layers. The various layers that make up the composite structure may be selected to each provide improved physical properties to the sheet material. The presently preferred packaging arrangement generally has three separate layers, each providing certain characteristics to the sheet material 50. Specifically, the sheet material advantageously includes a moisture barrier layer 52, a sealant layer 54, and a mechanical support layer 56, as described below. Those skilled in the art will appreciate that the sheet material 50 also could include a wide variety of layers of various materials having various properties and characteristics.

As discussed, the illustrated sheet material 50 includes the sealant layer 54, which is preferably made of a heat sealable polymer material, such as a thermoplastic material.

Such a layer can be melted to aid in the production of the sealing joints 34, 36, 40, 42. In a preferred packaging arrangement, the sealant layer 54 is the innermost layer in the sheet material 50 (i.e., the layer that lies directly adjacent the cavity 32).

The illustrated sheet material 50 also includes a moisture barrier layer 52 that lies adjacent the sealant layer 54. The moisture barrier layer 52 advantageously inhibits the passage of moisture through the sheet material 50 and into the cavity 32. The moisture barrier layer 52 is preferably made of a material that is both stretch and heat resistant so that the moisture barrier layer 52 is not substantially degraded during manufacturing. The selected moisture barriers desirably have a very low water vapor transmission rate. The effectiveness of the moisture barrier layer 52 depends, at least in part, upon its composition and its thickness.

The presently preferred moisture barrier layer 52 can comprise any of a wide variety of materials, such as polymers, reinforced polymers, metals or any combination thereof. In a preferred packaging arrangement, the moisture barrier layer is selected from the group comprising polyolefine, polyamide, ethylene vinyl alcohol polyester, polyacrylonitrile, (poly)vinylidene chloride, fluorocarbon polymer, as well as any blend of these materials, and metal. A thin and flexible metallic foil, such as aluminum foil, can also serve as a moisture barrier. The metallic foil is preferably adhered to a flexible plastic or paper support layer to obtain the flexible sealing member 22, as described below. Well known techniques can be used to adhere the metallic foil to a plastic or cellulosic layer, such as, for instance but without limitation, physical or chemical vapor deposition, adhesion by hot pressing with an adhesive film, deposition of molten thermoplastic on a thin aluminum foil.

One advantage of the present packaging arrangement is that the thickness of the moisture barrier layer 52 does not influence the characteristics of the ball as it does when a moisture barrier layer is integrated directly within the structure of the ball, as taught in UK Patent 2,280,379. Accordingly, the thickness of the moisture barrier layer 52 can be selected to maximize the moisture barrier characteristics without affecting the performance characteristics of the golf ball 21.

With continued reference to Figure 4, the illustrated sheet material 50 also includes a support layer 56, which preferably is the outermost layer in the sheet material 50. The

support layer 56 advantageously substantially protects the sheet material 50 against damaging events, such as scratching, abrading, heating and cutting. The support layer 56 also provides less-expensive protection for the sheet material 50. Moreover, because the support layer 56 protects and stiffens the sheet material 50, the moisture barrier layer 52 may be dedicated specifically to prevent moisture transmission and, therefore, may be comprised of a material having very high moisture barrier effects but very poor structural properties. The support layer 50 may be manufactured from a material chosen from the polyolefines, such as polyethylene, polypropylene, polybutylene, and ionomers, for instance but without limitation.

A specific high oxygen barrier layer (not shown) can also be used within the sheet material 50. In one arrangement, this oxygen barrier layer is interposed between the support layer and the sealant layer 54 in order to preserve a vacuum or pressurized state inside the packaging 20.

The laminate sheet material 50 may be manufactured using a co-extrusion process or by other suitable techniques such as hot pressing, calendaring, etc. Those skilled in the arts will appreciate that any wide variety of processes may be used to manufacture the laminate sheet material 50. Thin layers of adhesive or primer that promote adhesion between each layer can also be used when necessary. The sheet material 50 can be transparent, translucent, opaque or can be colored using inks, pigments, or any other variety of coloring materials or techniques. Moreover, indicia such as trademarks, logos, or other decorative features can be located on the sheet material 50.

Figures 5-9 illustrate another packaging arrangement having certain features, aspects and advantages in accordance with the present invention. With reference to Figure 5, the illustrated packaging 20 includes an externally rigid structural member 62 having a canister-like configuration. The structural member 62 preferably has a substantially elongated shape and desirably acts as a moisture barrier to inhibit moisture transmission to golf balls 21 stored within a hollow inner compartment 66. The inner compartment 66, which is generally defined by the structural member 62, preferably has a size that is large enough to store at least one golf ball 21. Desirably, the compartment 66 has a diameter that generally corresponds to the size of the golf ball to allow the size of the packaging to be minimized.

With reference to Figures 6 and 7, an opening 64 extends through the top of the illustrated structural member 62. As used herein, the term "top" is with reference to the views of the enclosed drawings and is not intended to limit the scope of the invention. The opening 64 preferably has a circular or similar shape that is large enough to allow a golf ball 21 to pass through. A sealing cap or cover 72 can be positioned on the top of the structural member 62 over the opening 64. The sealing cap 72 preferably has a shape that generally conforms to the shape of the opening 64 so that the sealing cap 72 can substantially hermetically seal the opening 64.

The inner compartment 66 of the structural member 62 can be pressurized prior to sealing the sealing cap 72 over the opening 64. Moreover, the inner compartment 66 may be filled with a material, such as a dry gas of a very low humidity or an inert gas, to reduce the likelihood of the golf balls 21 being exposed to moisture. As used herein, a dry gas has a relative humidity preferably less than approximately 15% at a temperature of 70° Fahrenheit. Nitrogen and helium gases are suitable inert gases. Dried air and dried CO_2 are suitable dry gases. Of course, other gases, drying agents, or desiccants can also be used.

The seal between the sealing cap 72 and the structural member 62 is preferably strong enough to maintain the pressurized gas within the inner compartment until the sealing cap 72 is removed from the structural member 62. The gas therefore escapes from the inner compartment upon removal of the sealing cap 72. Advantageously, the pressurized inner compartment 66 reduces the likelihood of moisture being transmitted into the container 20.

Desirably, the pressure within the inner compartment 66 is sufficient to create an audible indication, such as a hiss or pop of escaping gas, when a user breaks the seal between the sealing cap 72 and the structural member 62. Importantly, the audible indication enables the user to confirm the integrity of the seal by listening for the escape of gas during opening. A pressure of approximately 5-15 psi, and more preferably 10-12 psi, within the inner compartment 66 should be sufficient to create an audible indication when the seal is broken and the pressurized gas escapes from the inner compartment 66.

With reference now to Figure 7, the sealing cap 72 preferably has an edge 74 that bends inward toward the structural member 62. The illustrated edge 74 runs along the

entire perimeter of the sealing cap 72. The structural member 62 desirably has a complementary outwardly bending top edge 75. The bent edge 74 on the sealing cap 72 advantageously overlaps the top edge 75 of the structural member 64. The overlapping portion forms a connection that is substantially hermetically sealed. The sealed connection between the sealing cap 72 and the structural member 62 advantageously inhibits moisture transmission into the inner compartment 66 through the opening 64.

A pull tab 76 can be attached to the outer surface of the sealing cap 72. Thus, a user can open the structural member 62 by pulling on the pull tab 76 to break the seal between the sealing cap 72 and the structural member 62 and to remove the sealing cap 72. The golf balls 21 may then be removed from the structural member 62 through the opening 64.

With reference now to Figure 8, the structural member 62 preferably has an outer perimeter shape that conforms to a regular polygon, such as a rectangular, hexagonal or octagonal polygon shape. The outer surface of the structural member 62, therefore, preferably includes a plurality of elongated and substantially planar surfaces 80. Such a shape advantageously facilitates compact shipping and storage of many elongated bodies 62. This is accomplished by aligning the planar surfaces 80 of separate elongated bodies 62 flush against one another. The stacked arrangement allows the elongated bodies 62 to be packed close together during storage in order to save space. Although the polygonal shape facilitates compact storage of the structural members 62, the structural members 62 could also have other shapes, such as a cylindrical shape.

The structural member 62 is preferably made of a light-weight material such as aluminum or plastic. Golf balls 21 are preferably packaged within the structural member 62 under a humidity-controlled atmosphere to ensure that the inner compartment 66 of the structural member 62 has a relative humidity value that does not adversely affect the mechanical and physical properties of the golf balls 21.

With reference now to Figure 9, a portion of the structural member 62 is shown in cross-section to clearly illustrate the structural make-up of the packaging 20. In certain cases, the structural member 62 may be manufactured of a material, such as a plastic, that offers structural support for transport and storage and that is cost efficient but that does not act as an efficient moisture barrier. The structural member may also be manufactured of a

material, such as cardboard or another rigid material that is lightweight but permeable to moisture. In such cases, the material of the structural member 62 does not constitute a self-sufficient moisture barrier. Hence, a specific moisture barrier layer 52, such as that described above, can be laminated to the inner surface of the structural member 62. The moisture barrier layer 52 preferably adheres directly to the interior surface of the structural member 62. Alternatively, the moisture barrier layer 52 may be glued using an adhesive film (not shown). Moreover, the moisture barrier can be positioned inside or outside of the structural member 62 and can be unattached to the structural member 62 in some instances. The moisture barrier layer 52 advantageously provides an otherwise moisture permeable material with moisture barrier qualities.

As will be appreciated by those of skill in the art, the packaging arrangement of Figures 5-9 could also be filled under vacuum or pressure conditions and could also be filled with a dry gas or an inert gas.

Figure 10 illustrates yet another golf ball packaging arrangement. The golf ball packaging 20 illustrated in Figure 10 is similar to the golf ball packaging 20 illustrated in Figures 2-4; however, in the arrangement of Figure 10, the space within the cavity 32 that lies between the golf ball 21 and the inner wall of the sheet material 50 is filled under normal atmosphere pressure, or is pressurized, with a dry gas 82 of a very low relative humidity, such as those described above. The gas 82 can be dried using well-known techniques, such as condensation of the humidity at a low temperature until the dew point of the gas 82 is reached. The gas 82 advantageously assists the sealing member in inhibiting moisture transmission.

With reference to Figures 11 and 12, another container or packaging arrangement 20 comprises a structural member 100 having a cylindrical side wall 102 that extends upwardly from a base wall 104. Of course, the side wall need not be cylindrical, as described above. An upper edge of the side wall 102 defines an aperture 106 that communicates with an interior cavity 110 that is generally defined by the side wall 102 and the base wall 104. The interior cavity 110 is sized to receive at least one golf ball 21 and desirably has a diameter that substantially corresponds to the size of the golf ball 21.

With continued reference to Figure 11, a lip 112 having a contact surface 114 extends radially inward from the upper edge of the side wall 102 so that the lip 112

defines the periphery of the aperture 106. A thin, flexible lid or cover 116 can be positioned over the aperture 106 such that the peripheral edges of the lid 116 rest on the contact surface 114. The lid 116 preferably has a size and shape that roughly corresponds to the size and shape of the upper end of the structural member 100. A handle, such as a tab 118, is preferably disposed along the edge of the lid 116. Of course, the handle can also be located centrally on the lid or in any other suitable location.

With reference now to Figure 12, the lid 116 is normally maintained in a sealed relationship with the lip 112 to enclose the interior cavity 110. Toward this end, the contact surface 114 and/or the lid 116 can be coated with an adhesive material to secure the lid 116 over the lip 112. In addition, the lip 112 can be melted to create a bond between the contact surface 114 and the lid 116. Moreover, ultrasonic bonding can be used to secure the lid 116. The seal between the lid 116 and the lip 112 is preferably sufficiently strong to maintain the position of the lid 116 when the container 20 is handled. The seal can be broken by pulling on the tab 118 to remove the illustrated lid 116 from the lip 112, preferably so that the lid 116 is peeled from the lip 112, as best shown in Figure 11.

With reference to Figures 11 and 12, the illustrated container 20 is cylindrically-shaped, which advantageously facilitates manufacturing of the container 20. The container 20 also can take on other shapes, such as the polygonal shapes discussed above and shown in Figure 8, which facilitate compact storing of the containers 20. In one construction, the container 20 is blow molded or injection-blow molded (i.e., an injection molded premold is placed into a mold cavity having a shape corresponding to the shape of the container 20, the mold is then heated, heating the premold, and air is injected into the cavity to force the material to conform to the shape of the cavity). Other manufacturing methods will be apparent to those skilled in the art, such as conventional extrusion techniques. The use of extrusion techniques will produce a container having an aperture on both the top and bottom end, in which case a lid may be mounted over both apertures. Upsetting (i.e., forging) and other similar forming techniques can also be used.

The structural member 100 is preferably manufactured of a semi-flexible material. Aluminum and plastic, such as polyethylene terephthalate, are both suitable materials for the structural member 100. Other materials, such as composites and light gauge metals,

including tin, can also be used.

The lid 116 is preferably manufactured of a lightweight material that is resistant to the moisture transmission. The material used for the lid 116 is also desirably flexible to facilitate bending of the lid 116 as it is peeled from the lip 112. Desirably, the peripheral edges of the lid 116 are sufficiently non-sharp to reduce the likelihood of the edges cutting a user when the removed lid is handled. A metal foil, such as aluminum foil, may be used for the lid 116.

Again, as will be appreciated by those of skill in the art, the embodiment of Figures 11-12 could also be filled under vacuum, or under pressurized conditions, and also could be filled with dry gas or an inert gas. In operation, at least one golf ball 21, and preferably three golf balls 21, are stored within the interior cavity 110 and the lid 116 is sealed over the aperture 106 to enclose the golf ball 21, as shown in Figure 12. The lightweight material of the container 20 facilitates easy transport of the golf balls 21, such as by a golfer walking through a golf course. As mentioned, the golfer accesses the golf balls 21 by pulling the tab 118 and exerting a force on the lid 116 to break the seal between the lid 116 and the lip 112. Of course, any other suitable opening arrangement can also be used.

The containers 20 of Figures 11 and 12 are typically less expensive to manufacture than the containers of Figures 5-9. The containers 20 of Figures 11 and 12 also exhibit improved resistance to moisture transmission over current commercially available types of containers.

The present packaging is an efficient storage device for golf balls. The packaging advantageously preserves the designed performance characteristics of golf balls by inhibiting moisture transmission to the golf balls during storage and transport. The packaging is preferably comprised of a material that includes a moisture barrier layer, thereby eliminating the need to manufacture a moisture barrier layer directly in the golf ball structure, which can reduce golf ball performance and increase manufacturing costs. More preferably, the container has a lower vapor transmission rate than any of the components encasing the core of the golf ball.

When used in conjunction with the support layer 56, the present packaging preserves both the performance specifications of the packaged golf ball and the structure

of the ball. The packaging 20 may advantageously be used for prolonged storage of a golf ball or a collection of golf balls without concern for excessive moisture absorption. Hence, a golf ball that is stored within the present packaging may be designed to maximize performance. The designed performance characteristics of the ball advantageously are not substantially comprised degraded when the ball is first used, as is often the case with current golf ball packaging.

With reference now to Figures 13 through 17, another configuration of golf ball packaging with a removable and replaceable lid is illustrated therein. The illustrated configuration embodies various features, aspects and advantages of the present invention. With reference to Figure 13, the illustrated packaging 20 preferably includes an externally rigid structural member 130. The structural member may have any of a number of geometric configurations. For instance, as illustrated in Figures 14 and 18, the illustrated structural member 130 has an elongated canister-like configuration. In some arrangements, the structural member 130 may also have an outer shape that conforms to a regular polygon, such as a rectangular, hexagonal or octagonal polygon shape. Advantageously, the outer surface of the structural member 130 can include one or more elongated and substantially planar surfaces 131. Such a configuration advantageously allows a compact arrangement of many containers 20 side-by-side. In addition, the planar surface creates an excellent location for source identifying or product identifying indicia, or other labeling or decorations. Although the illustrated construction facilitates compact storage of the containers 20 and provides an ideal labeling location, it will be appreciated that the structural members 130 could also have other shapes, such as a cylindrical shape and any of a variety of shapes having planar panels arranged side-by-side.

The structural member 130 is preferably made of a light-weight and moisture resistant material such as aluminum or plastic. In one arrangement, plastic forms both the structural member and the vapor barrier. While the structural member can be formed of a light gauge metal, such as aluminum, a plastic structure offers several distinct advantages over aluminum. For instance, a plastic structure can allow a purchaser to visually inspect the contents while a metal arrangement is necessarily opaque. Similarly, a completely sealed metal can (i.e., without plastic end caps) cannot be opened and inspected while a plastic construction such as that disclosed herein creates a resealable nature such that a

purchaser can remove a ball in a store to touch or feel the ball and then reseal the container after replacing the ball.

The resealable plastic container also has the advantage of relieving the purchaser of the psychological concerns related to freshness. For instance, once a non-resealable container is opened, the freshness clock begins to tick. However, if the container is resealable, such as those disclosed herein, the clock can be repeatedly stalled by resealing the container. This relieves the weekend golfer of the concern of whether or not the packaged balls will receive adequate play for the amount paid.

On the manufacturing line, plastic also has several distinct advantages over a metal container. Due to the machines involved, the metal cans are simply more expensive and difficult to manufacture. For instance, special seaming machines are required to seal the lid to the container. Furthermore, due to the workable bend radii restrictions of metals, the containers are often slightly oversized. The oversizing can lead to rattling of balls during shipment as well as damage to the packaging in severe instances. Moreover, oversizing increases the overall size and weight of the packaging.

During shipping and handling, the weight of the packaging is often a concern because truck weight limits are likely exceeded by weight before area when shipping golf balls from a manufacturing facility. Metal containers are often about double the weight. Thus, the additional weight of the packaging becomes a serious cost and concern. Additionally, due to the use of a metal lid, the containers require an additional plastic lid to allow the containers to be resealed if such resealing is to be accommodated.

As will be appreciated, the present design of the container also includes a neck in the region of the lid. This neck allows the packaging to have a uniform cross dimension. The uniform cross dimension allows the packaging to seat flush within outer packaging as well as decreases the overall size of outer packaging. Accordingly, shelf space may be reduced through the use of the present packaging.

In certain applications, however, the structural member 130 may be manufactured of a material, such as a plastic, that offers structural support for transport and storage and that is cost efficient but that does not act as an efficient moisture barrier. The structural member may also be manufactured of a material, such as cardboard or another rigid material that is lightweight but permeable to moisture. In such applications, the material

of the structural member 130 does not constitute a self-sufficient moisture barrier. Hence, a specific moisture barrier layer, such as that described above, can be laminated to the inner surface of the structural member 130. The moisture barrier layer preferably adheres directly to the interior surface of the structural member 130. Alternatively, the moisture barrier layer can be glued using an adhesive film (not shown) or otherwise suitably affixed in position. Moreover, the moisture barrier can be positioned inside or outside of the structural member 130 and can be unattached from the structural member 130 in some instances. The moisture barrier layer advantageously provides an otherwise moisture permeable material with moisture barrier qualities.

As described above, the structural member 130 advantageously forms a moisture barrier to golf balls that are stored within a hollow inner compartment 132. The illustrated inner compartment 132 is sized to accommodate at least one golf ball. Desirably, the compartment 132 forms an inner chamber with a cross dimension that generally corresponds to the size of the golf ball. As is known, the size of a standard golf ball is approximately 1.690 inches. Of course, to better protect the golf ball, the container preferably has an internal dimension of no more than about 1.780 inches in diameter. Such a sizing advantageously reduces rattling of the ball within the container. Also, the chamber desirably has a height that will accommodate three golf balls and is about 5.215 inches with a tolerance of about 0.050 inches in the illustrated arrangement. Of course, the size of the packaging can be altered to accept other size balls as necessary. The preferred sizing and configuration of the inner chamber 132 advantageously reduces the overall size and footprint of the packaging. As illustrated, the packaging preferably has a maximum footprint of about 1.940 inches.

The structural member 130 preferably has a wall thickness of about 0.030 inch. Accordingly, an outer diameter of the illustrated container is approximately 1.840 inches. Of course, the outer diameter preferably ranges between 1.890 and 1.790 inches when manufacturing tolerances are accommodated. As discussed above, the sizing, while advantageous, is not absolutely necessary to practice all aspects of the present invention.

With reference to Figure 18, the bottom of the present structural member preferably includes a raised ridge. The ridge lifts the lowermost ball above the storage shelf upon which the container rests. In the illustrated arrangement, the ridge lifts the ball

about 0.075 inches above the shelf. This removes direct pressure between the shelf and the ball and places a flexible and cushioning portion of the illustrated structural member between the ball and the shelf while maintaining a lower overall height to the structural member. Of course other elevations may also be used.

With continued reference to Figure 13, a rim 135 defines an opening 134 that extends through the top of the structural member 130. The opening 134 preferably has a minimum cross dimension large enough to allow a golf ball to pass relatively unrestricted through the opening 134. The opening can also be sized such that the ball is slightly restrained within the opening and such that the ball must be shaken free of the opening 134. This arrangement can be accomplished in any manner known to those of ordinary skill in the art. In the illustrated packaging, the opening has a diameter of between about 1.700 and about 1.980 inches. Of course, the diameter is more preferably about 1.730 inches.

With reference now to Figure 14, a sealing cap or cover 136 is preferably capable of being positioned on the top of the structural member 130 over the opening 134. The illustrated cap is shown in a removed state but, as will be understood, is capable of being sealingly engaged with the structural member 130 to at least substantially close the opening 134. The sealing cap 136 preferably has a shape that generally conforms to the outer shape of the structural member 130 so that the sealing cap 136 can seals the opening 134. The cap 136 is desirably sized and configured to cover the opening 134 while maintaining a pressure-resistant seal on the container 20. This construction allows the container to be sealed under pressure when desired as well as allows the container to be substantially air-tight to limit the transmission of moisture through the connection between the container and the lid.

A clearance of approximately 0.210 inches is preferably provided between an upper edge of the rim and an enlarged diameter of the structural member. The clearance can also be between about 0.225 and about 0.195 inches in the illustrated arrangement. This clearance advantageously allows the cap to be easily positioned on the structural member and removed from the structural member. Of course other clearances and configurations are also possible.

With reference to Figures 15 through 17, an interlocking structure may be

arranged to stably secure the cap 136 to the structural member 130. As best shown in Figure 15, the structural member 130 includes a boss 138 that extends around the circumference of the structural member 130. The boss 138 has a lower surface that is preferably positioned about 0.110 inches plus or minus 0.015 inches below the uppermost surface of the structural member. The boss preferably extends outward between approximately 0.010 and approximately 0.030 inches. More preferably, the boss extends about 0.020 inches. The illustrated boss is advantageously formed integral to the structural member 130. The upper surface of the illustrated boss 138 slopes at an angle of approximately 30 degrees with the upper end of the sloping surface beginning approximately 0.110 inches below the upper surface of the structural member with a tolerance of plus or minus 0.015 inches. As explained above, other configurations of the boss are also possible; however, Applicant has determined this configuration adequate for the intended purpose.

With reference now to Figures 16 and 17, the lid 136 includes an inwardly extending lip 140 that is formed on a skirt of the lid. The skirt preferably slopes outward from top to bottom by about 2 degrees. Also, the skirt preferably extends downward about 0.268 inches from a top surface of the lid and about 0.218 inches from a bottom surface of the lid. The lip preferably has a minimum diameter of about 1.8431 inches. The lip also has a first tapered surface that extends between this minimum diameter and a diameter of approximately 1.8731 inches at the lowermost end of the skirt. This first tapered surface slopes at approximately 11.5 degrees from vertical. A second tapered surface extends between the minimum diameter and slopes upward at an angle of about 45 degrees from vertical in the illustrated lid. Thus, the illustrated lip has an overall height of approximately 0.094 inches with the minimum diameter portion positioned about 0.074 inches above the lowermost end of the skirt. The lip 140 cooperates with the boss 138 to secure the lid 136 to the structural member 130 and the components are advantageously sized accordingly. Advantageously, the illustrated lip 140 and the illustrated boss 138 extend in an uninterrupted ring to ensure complete sealing. It is anticipated, however, that in some arrangements the lip or the boss may be serrated, segmented or interrupted.

To better seal the opening 134, the lid 136 includes a downwardly depending flange 142. The illustrated flange preferably extends downward about 0.042 inches from

the bottom surface of the lid. The flange 142 includes a sloping outer face that contacts an inner edge of the structural member 130. The illustrated sloping outer face is preferably an arcuate surface having a radius of about 0.075 inches that results in a flange base width of about 0.032 inches. Specifically, the structural member preferably includes an inwardly tapering rim 135. The illustrated rim extends inward to define a diameter of about 1.720 inches while the flange defines a diameter of about 1.740 inches at its outermost portion and 1.676 inches at its innermost portion. The rim 135 and the flange 142 cooperate together to secure the seal on the illustrated container 130. Such a construction better seals the compartment 132 and allows the segmented or serrated rings to be used to secure the cap to the container, for instance. Of course a serrated, interrupted or segmented rim or flange can be used in some arrangements.

Also, if the compartment 132 is pressurized, the internal pressure advantageously urges the flange 142 outward against the wall of the compartment to even better seal the compartment 132. The seal between the sealing cap 136 and the structural member 130 is strong enough to maintain the pressurized gas within the inner compartment 132 until the sealing cap 136 is removed from the structural member 130. The gas therefore escapes from the inner compartment upon removal of the sealing cap 136.

Desirably, the pressure within the inner compartment 132 is sufficient to create an audible indication, such as the hiss or pop of escaping gas, when the user initially breaks the seal between the sealing cap 136 and the structural member 130. Importantly, this enables the user to confirm that the integrity of the seal was intact by listening for the escape of gas when the seal breaks. An internal pressure of approximately 5-15 psi, and preferably 10-12 psi, within the inner compartment 132 is sufficient to create an audible indication when the seal is broken and gas escapes from the inner compartment 132. This audible indication due to such pressurization is obviously applicable to other packaging arrangements disclosed herein. Advantageously, the pressurized inner compartment 132 reduces the likelihood of moisture being transmitted into the container 20.

Golf balls are preferably packaged within the structural member 130 under a humidity-controlled atmosphere to ensure that the inner compartment 132 of the structural member 130 has a relative humidity value that does not adversely affect the mechanical and physical properties of the golf balls. As indicated above, the inner compartment 132

may be filled with a material, such as a dry gas of a very low humidity or an inert gas, to reduce the likelihood of the enclosed golf balls being exposed to moisture. As used herein, a dry gas has a humidity preferably less than approximately 15% at a temperature of 70° Fahrenheit. Nitrogen and helium gases are suitable inert gases. Dried air and dried CO_2 are suitable dry gases.

The present container has an overall weight of approximately 18.2 grams unpacked. Preferably the weight of the unpacked container is about 1.900 grams with a tolerance of about 0.050 grams. Of course, the container may have other weights, but the weight should be reduced as much as possible without detracting from the structural characteristics discussed herein.

The following discussion of vapor barriers relates to each of the packaging arrangements of Figures 2-17. Although others have raised issues with respect to the vapor transmission rates of prior art containers, it is believed that a moisture barrier having a moisture transmission rate of less than about 2.4 grams per 100 square inches per day at 100°F and 90% relative humidity would be an improvement over existing golf ball packaging. It is further believed that a barrier having a vapor transmission rate of less than about 1.8 grams per 100 square inches per day at about 100 degrees Fahrenheit and about 90 % relative humidity would be a greater improvement over the prior art golf ball packaging. It is also believed that a moisture barrier having a vapor transmission rate of about 0.8 grams per 100 square inches per day at about 100 degrees Fahrenheit and about 90 % relative humidity would be an even greater improvement over the prior art. More preferably, the packaging has an average moisture vapor transmission rate of less than about 0.4 grams per 100 square inches per day at 100°F and 90% relative humidity; however, even more preferably, the packaging has an average moisture vapor transmission rate of less than about 0.2 grams per 100 square inches per day at 100°F and 90% relative humidity. Most preferably, the barrier should have a vapor transmission rate of about 0 grams per 100 square inches per day at 100 degrees Fahrenheit and 90 % relative humidity. Generally speaking, the thicker the layer, the better the moisture barrier characteristics it will have. While it is desirable to have a relatively thin barrier to minimize size and weight, this goal will, of course, need to be balanced against the cost of the material.

It is preferable that golf balls stored within the inventive packaging lose less than about 1 mile per hour in initial velocity at about 72 degrees Fahrenheit and about 50 % relative humidity over 12 months. This would limit degradation of the golf ball during the typical time period before the golf ball is sold by the manufacturer (i.e., four to twelve months) if the golf balls are stored at room temperature (about 72 degrees Fahrenheit). To generally limit degradation to this level, the effect of moisture on a particular ball composition can be accommodated by altering the vapor transmission rate of the packaging. As discussed above, most preferably the packaging has a vapor transmission rate of about 0 grams per 100 square inches per day at about 100 degrees Fahrenheit and about 90 % relative humidity. Advantageously, this can achieve a loss of less than 0.5 miles per hour over twelve months of storage at about 72 degrees Fahrenheit and about 50 % relative humidity.

Preferably, the golf balls lose less than about 1 mile per hour over 12 months when stored at about 110 degrees Fahrenheit and about 50 % relative humidity. This would limit degradation of the golf ball during the typical time period before the golf ball is sold by the manufacturer in instances in which the golf balls are warehoused in a hotter environment. To generally limit degradation to this level, the effect of moisture on a particular ball composition can be accommodated by altering the vapor transmission rate of the packaging. A loss of less than 0.5 miles per hour over 12 months at 110 degrees and 50 % relative humidity would be more desirable.

More preferably, the stored golf balls lose less than about 1 mile per hour over 24 months of storage at 72 degrees Fahrenheit. This would limit degradation of the golf ball during the time period up to when manufacturers currently suggest soft cover golf balls be used (i.e., two years), assuming the balls are stored at room temperature in a controlled environment. To generally limit degradation to this level, the effect of moisture on a particular ball composition can be accommodated by altering the vapor transmission rate of the packaging. As discussed above, most preferably the packaging has a vapor transmission rate of about 0 grams per 100 square inches per day at about 100 degrees Fahrenheit and about 90 % relative humidity. Of course, depending upon the applications, the acceptable vapor transmission rate can vary. In addition, a loss of less than 0.5 miles per hour over this time period and conditions would be more desirable.

Even more desirably, the stored golf balls lose less than about 1 mile per hour over 24 months of storage at 110 degrees Fahrenheit. This would limit degradation of the golf ball during the time period up to when manufacturers currently suggest soft cover golf balls be used (i.e., two years) in instances in which the golf balls are warehoused in a hotter environment. To generally limit degradation to this level, the effect of moisture on a particular ball composition can be accommodated by altering the vapor transmission rate of the packaging. Further, it is believed that a loss of less than 3 miles per hour or even less than about 4 miles per hour would be an improvement over prior art golf ball and packaging assemblies.

With reference now to Figures 19-23, the significance of the enhanced moisture barrier performance of the present packaging over prior packaging will be graphically illustrated. The graphs plot expected results.

Figure 19 is a graph of ball distance when struck by a driver versus the amount of time the ball has been stored for two basic types of golf balls and two different containers at 72° F and 50% relative humidity. Line 1 depicts distance versus time for a soft cover two-piece or wound ball that is stored within the type of promotional package disclosed in U.S. Patent No. 5,511,666 to Grip. As indicated, the golf ball distance decreases by approximately 14 yards over 4 years of storage. Significantly, much of this loss occurs over the first one to two years of storage. The importance of these last 14 yards is well known to golfers and can be the difference between having a nine iron to the green and having a seven iron to the green. Significantly, the higher lofted club permits the golfer to apply more backspin to the ball to increase the likelihood that the ball holds the green and does not bounce into a sand trap or water hazard. Due to this importance, golfers will go to great lengths to gain the elusive 14 yards.

With continued reference to Figure 19, line 2 depicts distance versus time for a soft cover two-piece or wound golf ball stored within container having certain aspects, features and advantages of the present invention. The golf ball experiences a decrease in ball distance of less than approximately 3 yards over 4 years of storage and experiences very little decrease over the first one to two years. The decrease in performance for golf balls stored within the containers of the present invention is significantly less than for golf balls stored in prior containers. Of course, other values may be expected from containers

having varying vapor transmission rates and the invention is not necessarily limited to the depicted lines.

Figure 20 is a graph showing ball velocity versus the amount of time a soft cover or wound ball has been stored within two different containers at 72° F and 50% relative humidity. Line 1 depicts velocity versus time for a golf ball stored within the Grip package. The velocity reduces by approximately 6 feet per second over 4 years of storage. This velocity loss is significant, as each foot per second of velocity corresponds to approximately 2.5-3 yards of ball distance. Line 2 depicts velocity versus time for a golf ball stored within a container having certain features, aspects and advantages of the present invention. Such a golf ball experiences less than 1 foot per second decrease in velocity over four years and virtually no loss in ball distance. Of course, other values may be expected from containers having varying vapor transmission rates and the invention is not necessarily limited to the depicted lines.

Figure 21 is a graph showing ball velocity versus the amount of time a hard cover ball has been stored within two different containers at 72° F and 50% relative humidity. Line 1 depicts velocity versus time for a golf ball stored within the Grip package. The velocity reduces by approximately 3 feet per second over 4 years of storage. Line 2 depicts velocity versus time for a golf ball stored within a container having certain features, aspects and advantages of the present invention. Such a golf ball experiences approximately 1 foot per second reduction in velocity over four years and virtually no loss in ball distance. Of course, other values may be expected from containers having varying vapor transmission rates and the invention is not necessarily limited to the depicted lines.

Figures 22 and 23 are graphs showing ball velocity versus the amount of time the ball has been stored within two different containers at 110° F and 50% relative humidity for a soft cover or wound ball (Figure 22) and a hard cover ball (Figure 23). Line 1 depicts velocity versus time for a golf ball stored within the Grip package. The velocity of a soft cover or wound ball reduces by approximately 7 feet per second over less than one year of storage. The velocity of a hard cover ball reduces by approximately 3 feet per second over less than one year of storage. Line 2 depicts velocity versus time for a golf ball stored within a container having certain features, aspects and advantages in accordance with the present invention. Both soft cover and hard cover golf balls

experience only approximately 1 foot per second reduction in velocity over less than one year and virtually no loss in ball distance when exposed at 110 F° at 50% relative humidity. Of course, other values may be expected from containers having varying vapor transmission rates and the invention is not necessarily limited to the depicted lines.

Figure 24 illustrates the change in the coefficient of restitution of a soft cover golf ball over a prolonged storage period. The data represents the changes resulting from storage in the inventive packaging and from storage in a prior art container. As will be recognized by those of ordinary skill in the art, the coefficient of restitution ("COR") is a ratio of outgoing velocity to incoming velocity. One way to measure the COR of a ball is to propel the ball at a given speed (i.e., 125 feet/second) against a massive hardened surface and then measure the outgoing velocity. There is no limit on the COR of a golf ball imposed by the United States Golf Association, but, as discussed above, the initial velocity of the golf ball can not exceed 255 feet/second under current USGA rules.

As also discussed above, the COR of a soft cover golf ball is adversely affected by prolonged exposure to moisture (i.e., humidity and water). Thus, the COR of the ball rapidly decreases if no protected during storage. Even average humidity for both indoor and outdoor conditions (i.e., 25-35 % relative humidity) at normal temperatures (i.e., 60-90 degrees Fahrenheit) can slowly drain valuable COR from the golf ball. Of course, elevated temperatures and humidity levels, such as those encountered in automobile trunks during the summer, can rapidly increase the rate of deterioration. With reference to Figure 24, the COR of the soft cover golf ball tested decreased by 1.5% over 12 weeks when packaged within a prior art package and subjected to uncontrolled environmental conditions. To the contrary, the soft cover golf ball packaged within a configuration of the inventive packaging disclosed herein only decreased by 0.126% over the same 12 weeks when subjected to the same environmental conditions. Thus, the packaging reduced the change in COR by about 10 times the illustrated prior art packaging

Although the foregoing description of the preferred embodiment of the preferred invention has shown, described, and pointed out certain novel features of the invention, it will be understood that various omissions, substitutions, and changes in the form of the detail of the apparatus as illustrated as well as the uses thereof, may be made by those skilled in the art without departing from the spirit of the present invention. In addition,

various disclosed aspects of the packaging arrangements can be readily adapted to the other disclosed packaging arrangements. Moreover, certain aspects of the disclosed packaging arrangements can also be omitted while practicing other aspects of the disclosed packaging arrangements. Consequently, the scope of the present invention should not be limited by the foregoing discussion, which is intended to illustrate rather than limit the scope of the invention.